

NASA TECH BRIEF

Lewis Research Center



NASA Tech Briefs announce new technology derived from the U.S. space program. They are issued to encourage commercial application. Tech Briefs are available on a subscription basis from the National Technical Information Service, Springfield, Virginia 22151. Requests for individual copies or questions relating to the Tech Brief program may be directed to the Technology Utilization Office, NASA, Code KT, Washington, D.C. 20546.

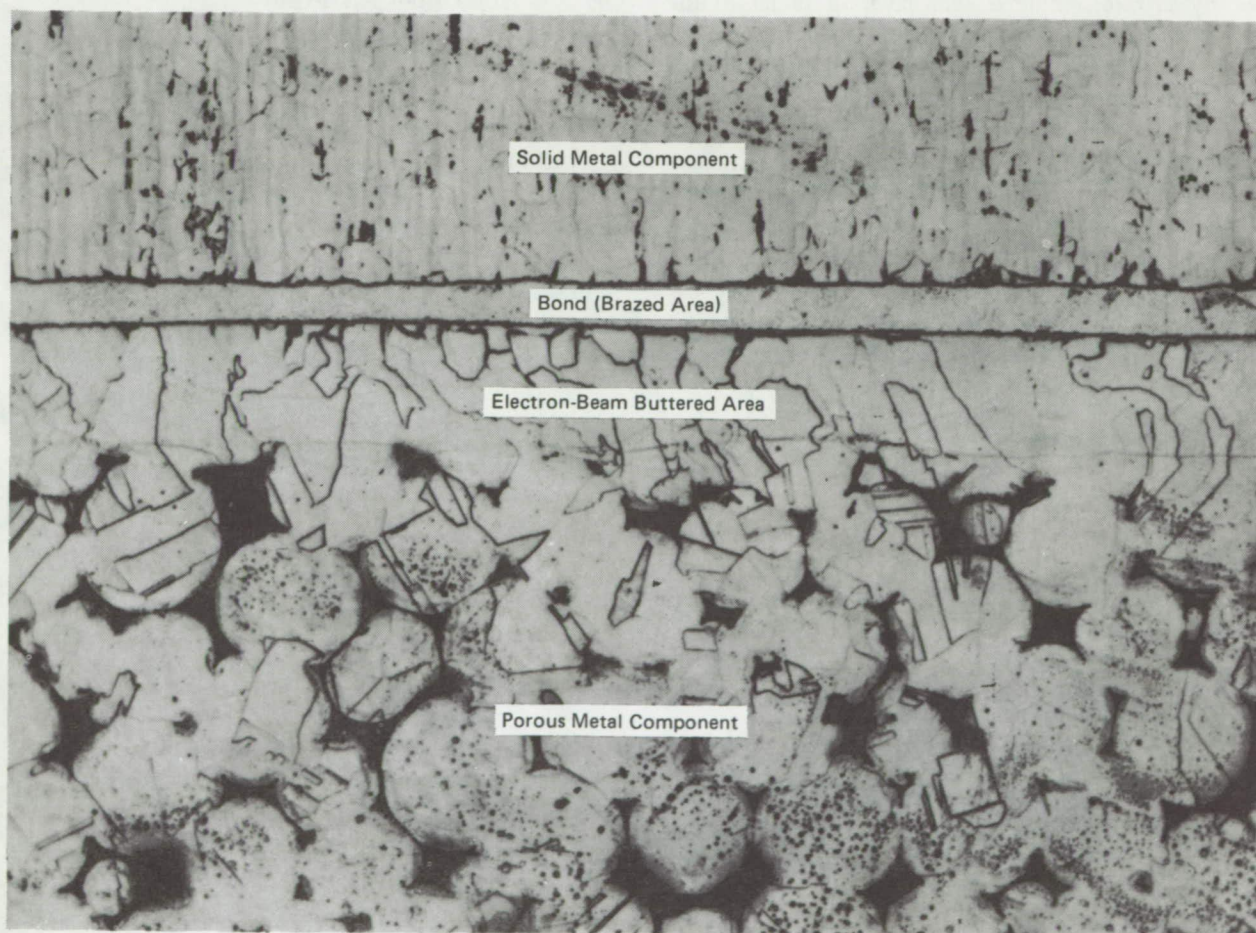
Joining Porous Components to Solid Metal Structures

The problem:

To join a porous metal material to a solid metal structure without cracking and blockage of the porous component. Electron beam welding the porous component directly to the solid metal causes cracks in the weld area. Brazing a solid material directly to a porous material cannot be done easily because the braze infiltrates the pores causing contamination and blockage.

Solutions:

1. Electron beam buttering (surface welding) the surface of the porous material, followed by brazing or electroforming of the porous component to the solid metal structure.
2. Electroforming a thin layer of metal to the surface of the porous material, followed by brazing of the porous component to the solid component.



(continued overleaf)

3. Electroform joining the porous component directly to the solid metal structure.

How it's done:

The joining operation is accomplished in one or a series of steps.

In the first technique listed, the surface of the porous component is sealed by melting a thin outer layer of the porous material with an electron beam so that the melted material fills all outer surface pores. The thickness of the surface coating may be varied from 0.025 mm to 1.3 mm (1 to 50 mils) by varying electron beam power. The porous metal component can then be either brazed or electroformed to the solid metal structure. Although electroforming is a slower process (depositing 0.025 mm or 1/1000 inch of metal per hour), it is inherently a cheaper process and is often preferred when compared to the complications which may be involved in brazing. As the micro-photograph shows, this joining technique produces a good bond without cracks and without contamination of the porous material.

More recently, this joining technique has been modified by electroforming a thin layer of metal to the surface of the porous material and then brazing the porous metal component to the solid metal structure.

Alternately, the braze cycle can be eliminated by joining the porous component directly to the solid metal structure in a one-step electroforming operation.

The choice among the three techniques depends on various factors such as the size of the pores in the porous material, the type of metals being joined, the conditions (temperature, pressure) under which the

final structure is to be used, the time required to perform the joining operation, etc.

Notes:

1. This joining technique can be applied to the fabrication of filters and/or transpiration cooled bodies such as turbine blades, jet engine combustors, nozzles, and rocket chambers.
2. Additional information is contained in NASA Tech Brief 68-10331, "Electron Beam Selectively Seals Porous Metal Filters."
3. The following documentation may be obtained from:
National Technical Information Service
Springfield, Virginia 22151
Single document price \$3.00
(or microfiche \$0.95)

Reference: NASA CR-72994 (N71-38071),
Characterization of Porous Metal Matrices for
Transpiration Cooled Structures

4. Technical questions may be directed to:
Technology Utilization Officer
Lewis Research Center
21000 Brookpark Road
Cleveland, Ohio 44135
Reference: B72-10754

Patent status:

NASA has decided not to apply for a patent.

Source: Anthony Fortini and George Tulisak
Lewis Research Center
(LEW-11259)